HYDROSHIFT

Shifting mining waters from burden to resource

Water4All
Water security for the planet

Coordinated by Early Career Researcher

Abstract

Acid mine drainage (AMD) is one of the most persistent environmental legacies of mining. This acidic water, rich in toxic elements, contaminates ecosystems over extended periods, creating costly, long-term liabilities and requiring continuous treatment to protect ecosystems and human health. While widely implemented technologies such as lime neutralization effectively remove contaminants from water, they generate large volumes of treatment residues that accumulate on site and often contain significant concentrations of metals. At the same time, growing geopolitical tensions and the energy transition are increasing pressure on the supply of critical raw materials (CRMs).

HydroShift proposes to shift the paradigm in AMD management by transforming these long-term environmental liabilities into potential sources of valuable metals. The project focuses on two goals:
Metal Recovery Innovation from AMD and AMD residues: The project will develop and evaluate innovative technologies to extract valuable metals, including cobalt, nickel, copper, zinc and rare earth elements, from AMD with different compositions and site conditions. Based on the combination of biological processes, electro-driven technologies and innovative hydrometallurgical approaches, the objective is to produce marketable metal products, cleaned residue matrices suitable for safer storage or reuse, concentrated fractions of hazardous contaminants for secure disposal and finally output water that meets water quality compliance thresholds. By integrating process simulation with life cycle assessment (LCA), the project ensures these methods are economically viable, scalable, and environmentally optimized, supporting sustainable water management. During LCA assessment, the project aims at better defining the water footprint indicator in the mining sector, as this aspect is today poorly considered in the LCA of AMD prevention or remediation techniques.
Addressing economic and policy challenges: Through national inventories of CRM fluxes in AMD and stocks in treatment residues, HydroShift will quantify the potential resource base represented by these anthropogenic deposits. A decision-support flowchart will be developed to guide the selection of appropriate technologies depending on AMD characteristics, site conditions, and economic factors. A transnational stakeholder committee, bringing together industry, regulatory authorities, environmental and research organizations, will help identify barriers and opportunities for implementation.

The project's multidisciplinary consortium aims to demonstrate how AMD management can contribute to both environmental protection and the circular supply of critical raw materials. This project will serve as a model for other water-intensive sectors, demonstrating the potential to convert industrial waste into a valuable resource. Through outreach, open science practices, and dissemination, HydroShift aims to set new standards in AMD management and foster a long-term shift towards circular water use. The project will provide new tools and knowledge to help transform mining water treatment from a long-term burden into a strategic resource opportunity.

Project coordinator

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Project partners

- CASPEO SARL - FRANCE
- UNIVERSITY OF HUELVA - SPAIN
- TAMPERE UNIVERSITY - FINLAND
- USTAV GEOTECHNIKY SLOVENSKEJ AKADEMIE VIED - SLOVAK REPUBLIC
- NATURAL RESOURCES CANADA - CANADA

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